Behavior of the Male *Trypoxylon rubrocinctum*

(Hymenoptera: Sphecidae)

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The following observations on male *Trypoxylon* behavior were made five miles north of Grants Pass, Oregon, at 1,150 ft. elevation. The nests were in 6.4 mm holes bored in several old posts set up on the north side of a building. Notes were taken during approximately thirty hours of observation over a period of two years; July and August 1968 and 1971. Seven nests were studied, two in 1968, five in 1971. In each case the males were actively helping the females. Identification of specimens was made by Mr. Robert Every of Oregon State University, Corvallis, Oregon.

That, in some species, the male *Trypoxylon* guards the nest and occasionally helps the female has been known since the original work of the Peckhams in 1898. However, knowledge of the behavior of the male, other than his guard duty, is fragmentary, and the object of my studies was to determine the actions of the male from the beginning of a nest, through provisioning and partition building, to final closure.

This was accomplished by the use of a magnifying glass wired to the post four inches from the boring under study. Observation of activity within the nest was facilitated by the use of a 4× hand lens and a flashlight held to throw a beam of light into the interior. While working, both inside and outside of the nest, the wasps were remarkably tolerant of these arrangements, and after a short time of adjustment, proceeded with their work in a normal manner.

Beginning and Provisioning of the Nest.—In contrast to the males studied by the Peckhams (1895) I found three males helping the females clean out the borings before storage of prey. Both wasps worked at the back of the tunnel and seemed to be smoothing the walls with their mandibles, working together from side to side. Occasionally one or the other would come to the entrance and drop a load of fine sawdust outside. After an hour or so of this preparation the female would fly off to hunt while the male remained in the nest. With only one exception, the males constantly guarded the doorway while their mates were absent (Fig. 1). Also, with this same exception, the males guarded the nest entrance at night. In three nests, during early provisioning when there was much space in the boring, the female remained in the nest with the male all night.

The Pan-Pacific Entomologist 49: 26–30. January 1973

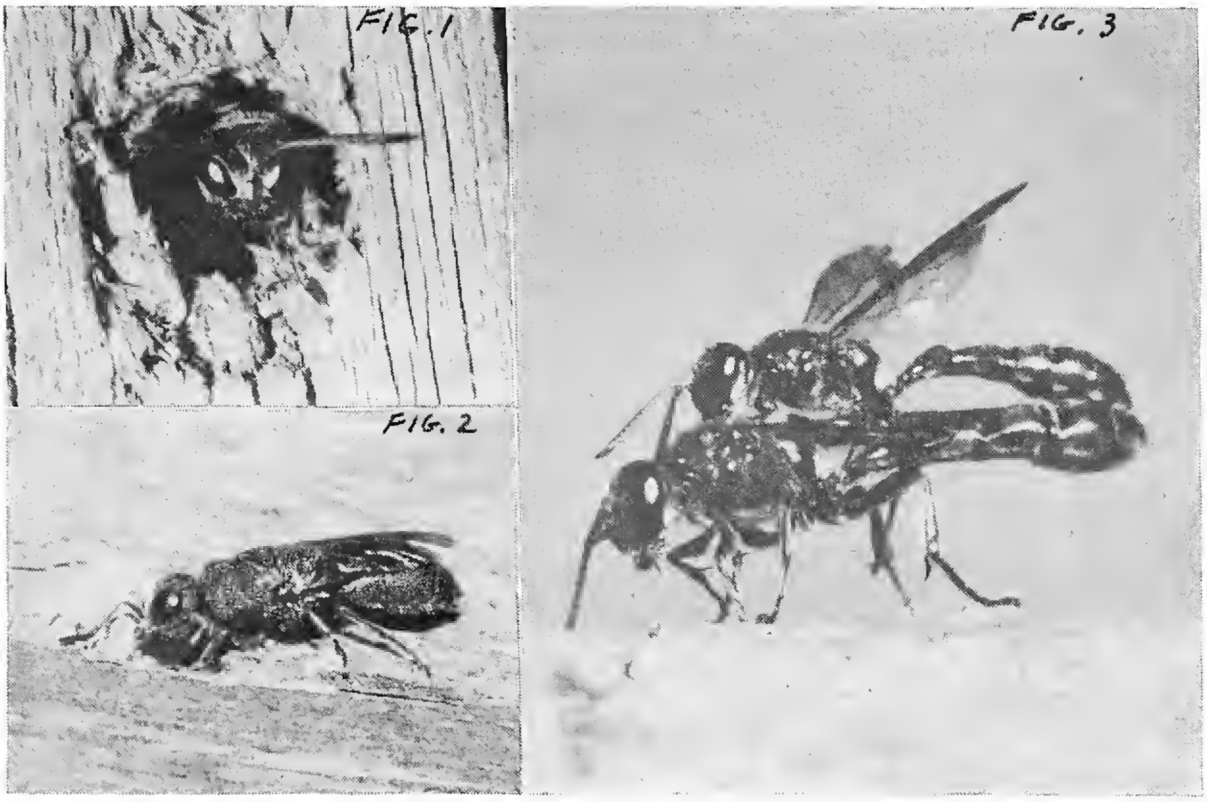

FIG. 1. Male *Trypoxylon* guarding his nest. FIG. 2. A cuckoo wasp breaking into nest of *Trypoxylon*. This nest was tightly sealed with hard clay, but note the large hole the parasite has already made. FIG. 3. Pair of *Trypoxylon* wasps mating at nest entrance.

All males studied exhibited a challenging attitude upon the approach of the female with prey, but after identifying her, their actions varied somewhat while allowing her to enter the nest. Some backed down the tunnel when there was room to do so, while others came outside and rode in on the female's back. One individual came out, slipped beneath the female as she entered, seized the spider, placed it in the cell, doubled himself in half and returned to the entrance facing outward.

Two pairs had a very distinctive ritual of recognition on the return of the female. Before allowing her to enter, the male grasped each of her antennae in his mandibles and stroked it with a cleaning motion, then with much head bobbing on the part of both, he permitted her to enter. The other pairs performed their greetings more after the manner of the wasps mentioned by Rau (1928)—merely touching antennae and nodding heads briefly at the entrance.

From the beginning the males appeared motivated to participate in storing the prey, but in four of the nests the female was sometimes reluctant to drop the spider and often a wrestling contest ensued. This contending for the prey started at the entrance and continued the length of the tunnel. However, as storing of the nests progressed, and under pressure of work, all but one of the females eventually allowed the males to participate, often dropping the prey inside the door and leaving the male to arrange it as he pleased.

Three females, even at the onset of provisioning, allowed the males to take the prey at the entrance, two willingly giving up the spider when the male reached outside and took it from them. These were the three pairs that exhibited the most cooperation throughout, and whose males appeared the most skilled in helping their mates. But in all these nests there were periods when the female reversed her cooperative behavior, and for a time refused to allow the male to handle the prey. This seemed to occur after she had been out hunting longer than usual. Then as she began bringing in prey at more frequent intervals (15 to 20 minutes) she again relinquished the prey to the male.

All the males who helped their mates store prey worked in the same manner. At first, when there was plenty of room, they merely placed the spider at the back of the boring and shoved it lightly into place with the head, turned around, (usually inside) and began cleaning face and antennae. Later when the provisions were closer to the entrance, after a few ramming motions with the head, they would turn around outside, back in and shove and push the bulky prey into place with the feet or tip of abdomen—some even hooking their legs over the outside edge of the boring to obtain greater leverage.

The Partition.—After a sufficient number of spiders (from 5 to 15) had been put away and an egg laid, usually on the last (Krombein, 1956), the female brought in mud and made a partition to seal off the cell. All my observations agree with Hartman (1905) that the mud partitions and outer barriers are started from the bottom up. In three of the nests the males appeared to be helping the female in trowelling the mud for this inner wall. Both wasps stood together, rotating in unison, as they worked from side to side spreading the wet clay. The wings of both vibrated rapidly and each emitted a high pitched buzzing sound while working. The males who did not participate in this activity merely moved to the front of the boring and allowed the female to place the mud unhindered. One male seemed particularly stubborn about moving aside, and his female had difficulty building her partitions.

Parasites.—The wasps had few parasites, but one or two females of the brilliant metallic green cuckoo wasps (Chrysididae) were always hanging about inspecting empty borings, and warily eyeing the males guarding their doorways. Medler (1967) suggests that the presence of *Chrysis* and others in a nest may be due to inadequate protection by the male *Trypoxylon.* However, on several occasions I observed a prowling *Chrysis* wasp attempt to enter a boring when the male was back in the tunnel, only to come out immediately, to all appearances greatly agitated, pursued by the alert guard. If there was much activity about a nest, or if the guard was sitting at the entrance where he could be seen the parasites never attempted to enter, but they seemed to take a great deal of interest in the closed borings. One afternoon I watched one of these wasps gnawing at the closed and hardened mud door of a *Trypoxylon* nest until it had succeeded in cutting through into the vestibular cell where it immediately began working at the inner partition (Fig. 2). Systematically, in the days to follow, it worked at one nest after another until I put adhesive tape over all the completed borings to protect them from being ruined.

The Last Cell.—While the female was building her cells deep within the nest I was unable to observe egg laying, but as the last cell was provisioned both wasps were unable to completely enter the boring, and they were close enough to the entrance to be seen easily. On four occasions, involving two nests, I was able to see the mating and the actions of both wasps as the female deposited an egg on the last spider brought in. After arranging the prey, the wasps took up positions facing each other, one inside, the other outside the nest. After much head bobbing, antennae waving and mandible clashing, the wasp inside came out and they mated while clinging to the post an inch or so from the entrance to the nest (Fig. 3). At once the female backed into the nest, head, front feet and thorax outside, and remained perfectly still. From time to time there was a slight quivering and tensing of the antennae. Three times the male waited, rigidly alert, watching the female. One male, when the female's antennae began to vibrate, became quite agitated and reared up on four legs, holding the bent first legs up under his head. So absorbed was he that I was able to approach within inches and make a number of pencil sketches of his unusual attitude.

Closure of the Nest.—All the *Trypoxylon* pairs observed closing nests (five out of seven) made an inner door, leaving a vestibular cell between the last occupied cell and the outer barrier. Two of the males left after the final cell was provisioned, and before the entrance was sealed, but three of the more attentive stayed with the females until the closing, though they were forced to rest on the post beside the entrance. One persistent male spent the last night resting in the vestibular cell, and halfway out of the nest when darkness came before the female finished the closure.

None of the males who remained until the nest was finished attempted to help the female with building of the mud barrier, though they had seemed to be assisting with the inner partitions. While not actively participating, these males appeared intensely interested when the female began making the vestibular cell wall, and hovered protectively over her as she worked. The attentive one mentioned above stood with a leg over the female's back as he appeared to be trying to watch the work in progress.

In general, it seemed that the more attentive and helpful the male, the longer he stayed with the nest. The males from nests where there was little cooperation between the pair were the ones who left early, often before the female began making the inner door. The one male of all the nests studied who stayed until the last mud pellet was spread on the final barrier, and who even came back several times with the female to inspect the closed nest, was the one who had been allowed by the female to share most in the work.

The last nest was provisioned and sealed on 13 August, and from that time I saw no more females although the males continued to fly about until 28 August. Every night several males rested in the empty borings until that date, when the weather turned unusually cold, then they disappeared from their old haunts, nor were they to be found on the asters or Michaelmas daisies of the garden.

Literature Cited

Hartman, C. 1905. Observations on the habits of some solitary wasps of Texas. Univ. Tex. Bull. No. 65, Sci. Series No. 7. 72 p.

Krombein, K. V. 1956. Proc. Ent. Soc. Wash. 58. No. 3: 155–156.

Medler, J. T. 1967. Biology of *Trypoxylon* in trap nests in Wisconsin. Amer. Midland Natur., 78: 344–358.

Peckham, G. W. and E. G. Peckham. 1895. Notes on the habits of *Trypoxylon rubrocinctum* and *Trypoxylon albopilosum*. Psyche, 7: 303–306.

1898. On the instincts and habits of solitary wasps. Wis. Geol. Natur. Hist. Surv. Bull. No. 2. 245 p.

Rau, P. 1928. Field studies in the behavior of the non-social wasps. Trans. Acad. Sci. St. Louis, 25: 489 p.